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OCEANUS

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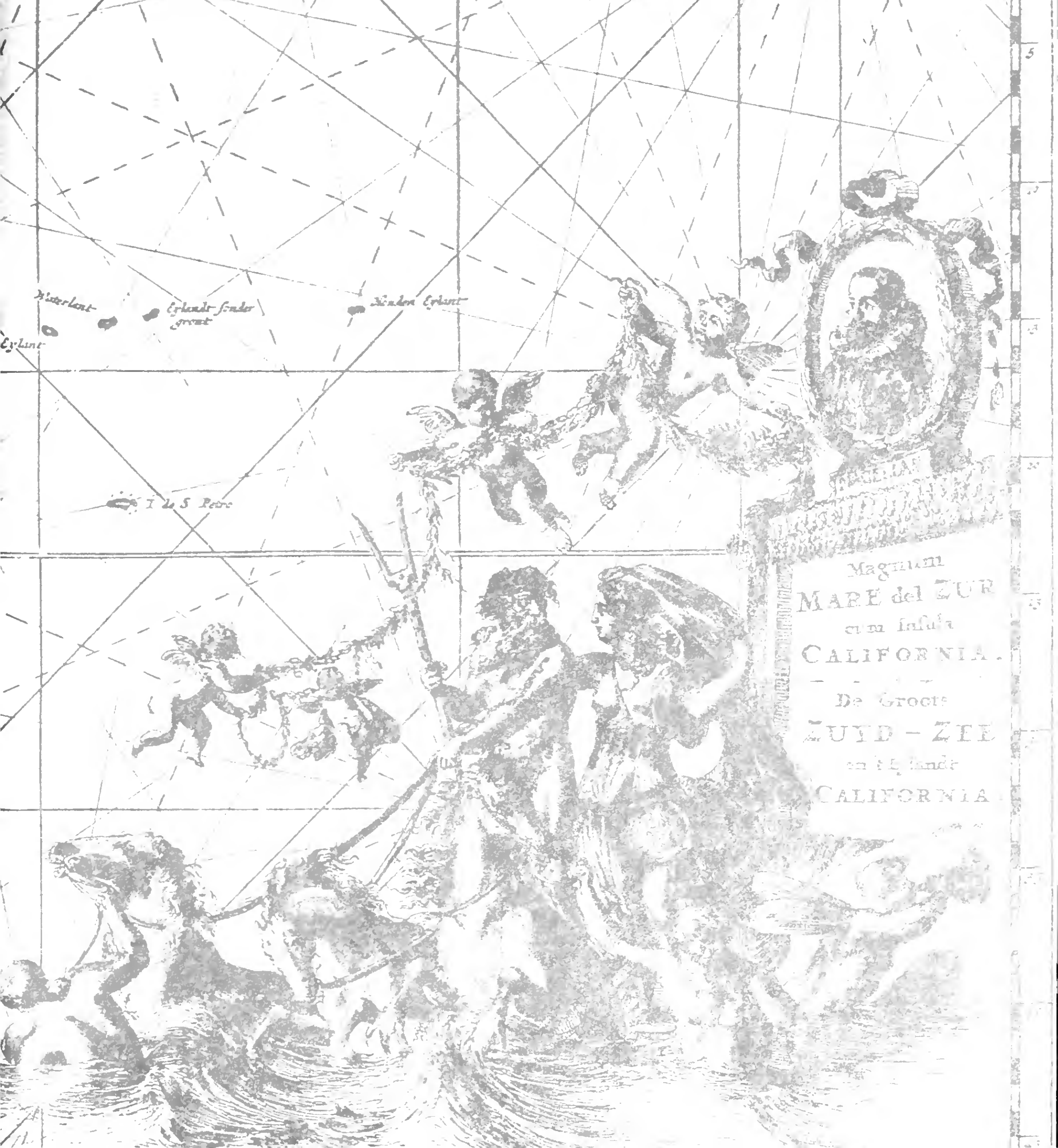

OCEANUS

EDITOR: JAN HAHN

Published quarterly and distributed to the Associates of the Woods Hole Oceanographic Institution and others interested in Oceanography

Woods Hole Oceanographic Institution

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INSULA CALIFORNIA

The Iland California is situated along the coast of New Mexico otherwise known as New Granada, from which it is separated by the Ruby Sea, on which we have indicated the Coast of Pearls. Discovered by the Spanish in 1535, California was long neglected since one did not find the expected riches.

A fort was constructed at the Bay of San Juan, called by the natives the Congo. The fort had four small bastions and a very good ditch, a parade ground and barracks for soldiers. Jesuits and missionaries, who received an annual pension of six million Ecus from King Philip V, built a chapel near the fort.

The natives have no form of government, no religion or culture, understand rapidly what one wants and are most docile in performing any task they are set to do. There are no cities, villages or houses, the natives camp in the woods like beasts, in groups of 30 to 40 families.

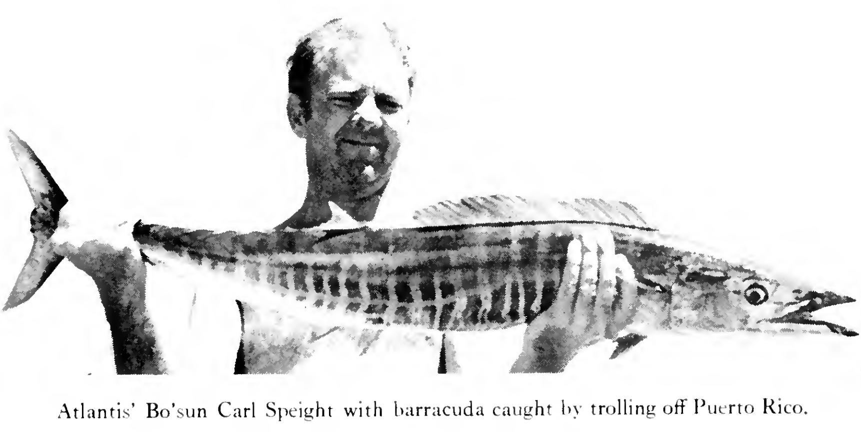
The heat is very great along the coast during the summer and it rains but rarely, but inland the breeze is temperate and the heat is never excessive. It is the same in winter in proportion.

The Spanish obtain salt, crystal, emeralds, pearls, much gold and silver, and other articles similar to those obtained in Mexico or New Spain.

(*From a description in L. Renard's Atlas de la Navigation, 1715*)

Summer Days at Woods Hole

THE halls of the laboratories, the grounds, the piers, are filled with people bustling, carrying sheaves of paper or charts, strange apparatus or faraway expressions; *Atlantis* leaves at nine for the Gulf Stream, Dr. Rossby speaks at eleven on the transport of sea salt by wind currents; *Bear* arrives from Georges Bank, Dr. Bigelow speaks at noon; a porpoise arrives by plane from Florida, Jim Moulton leaves on the *Claire* for his raft; Dr. Ewing's lecture is at three, David Owen is blowing bubbles under the dock; there are visitors, staff meetings, more lectures; coattails flying, Dr. Ketchum buzzes across the street to deliver his lecture at the M.B.L., there is a sssshhhh conference in the Laboratory of Oceanography, irate tourists are asking for exhibits; Carl Hayes departs with his jeep and dory to research the beach, Mr. Iselin returns from California, Dr. Redfield and "Rocky" Miller leave for Washington; miles of cable and tons of equipment are assembled and lugged to the ships, a lobster is growing a new claw in Turner's tanks; there's a square dance at nine, an M.B.L. movie at eight, but don't miss the benefit Gilbert and Sullivan show at seven thirty; there are more visitors from Japan, from Germany, from Ireland, from across the street; Mr. Schell speaks at eight on the principles of dynamic persistence and the implications for long-range predictive relationships, there is — Ah! Labor Day.



Atlantis' Bo'sun Carl Speight with barracuda caught by trolling off Puerto Rico.

Bird Watching

Sea observations of land and sea birds were discussed during a seminar held in June: "Contributions to ornithology resulting from observations at sea." Dr. A. C. Redfield, Susan Scholander and Malcolm Gordon presented their observations, followed by lively discussions.

Bird records were kept for many years by Harold Backus, who retired as Chief Engineer of the *Atlantis* after twenty years service. Lately, Captain Scott Bray has received bands from the Audubon Society to mark the land birds which not infrequently come to rest on board the *Atlantis* at sea. Other observations were made last month by Mr. Robert L. Grayce of the Audubon Society who joined the R.V. *Bear* for a short cruise to Georges Bank.

Receives Doctorate

Physical Oceanographer William S. von Arx received a Doctorate of Science in Meteorology at Commencement Exercises at the Massachusetts Institute of Technology. His thesis was entitled: "An experimental study of the dependence of the primary ocean circulation on the mean zonal wind field."

Dr. von Arx is the first staff member to obtain a doctorate under the Institution's 1954 program allowing one of its younger staff members a year's leave of absence for graduate studies in one of the earth sciences.

"Texas Towers" towering above sea level

The radar warning "Texas Towers" on Georges Bank were raised above sea level on Friday afternoon July 15. This must have been a great moment for Dr. John W. Zeigler, Research Associate in Marine Geology, who was standing by on board our research vessel *Bear*. Dr. Zeigler was responsible for the geological investigations which aided in the location of the site for the towers. The R.V. *Caryn* and *Bear* have made many cruises along the coast during the past year making observations with the aid of echo sounders, coring tubes, current meters, and other instruments while Dr. Zeigler, David Owen, William D. Athearn and others also made visual observations of the bottom by aqualung diving.

Senior Oceanographer C. O'D. Iselin was in charge of the consulting work done by this Institution and provided oceanographic information which influenced the design and location of the structures.

World Plan for Marine Research

The *Unesco Courier*, number 5, 1955, is largely devoted to articles on the scientific exploration of the sea. In the editorial, Gerald Endt, announces that *Unesco* is organizing a broader international attack on the problems of the sea, as it has successfully done for the problem of arid lands. The major practical objective of *Unesco's* program will be an increase in the availability of fish for human food.

Cruise A-215. From left: W. G. Metcalf, C. H. Malicoat, G. B. Ferguson, Jr., A. J. Faller, L. V. Worthington, P. Hughes.

Deep Water

About one fifth of the entire Atlantic Ocean is deeper than 5,000 meters or 16,404 feet. Until last year only five observations of temperature, salinity and oxygen content had been made below that depth in the western North Atlantic by ships of all nations. During 1954 oceanographer L. Valentine Worthington made 17 observations below that depth to test his hypothesis on the age of the Deep Atlantic Water. When the *Atlantis* returned last month from cruise No. 215, Mr. Worthington and his shipmates had added another 15 stations to this record.

The five weeks cruise was remarkable also in that 73 hydrographic stations were occupied in the western North Atlantic. All observations were made as close to the bottom as possible. Two sections were made across the Florida Current and one across the Gulf Stream.

Perhaps the most remarkable event of the remarkable cruise was the fact that the weather was universally excellent. Oceanographer F. C. Fuglister who will make a Gulf Stream cruise in August remarked accusingly to Worthington: "You have used up all the good weather."

The future generation has to be considered.

The Engineer and The Biologist

By Bostwick H. Ketchum

Man is important to himself but not terribly important to biological life.

ALL engineering practices and advances have direct biological consequences. The biological system of nature is so delicately balanced that anything that is done is likely to change it by eliminating or destroying part of the ecological system and interrupting the natural chain of events. Nature abhors a vacuum in the biological as well as in the gaseous state, so that any disturbed community is replaced by another to start the never ending succession towards a stable replacement.

Is this good or bad? Frankly, the biologist does not always know. It has become the practice among some of those concerned with biological conservation to condemn all engineering activity as a deadly foe of the biological system. Historically there is ample basis for this attitude, and we now realize that many activities yielding immediate benefit have, in the long run, been detrimental to man's welfare. The era of plenty is not yet at a close, but the time for careful conservation of our resources is at hand lest we be confronted with scarcity in place of plenty.

The responsibility for careful conservation is multiple, facing not only the biologist and the engineers, but the entire human population. A disregard of nature has become a major disease. Nature can be conquered or controlled for the benefit of man, but only on her own terms, and we humans must learn that we cannot disrupt the natural chain of events without substituting something for it. Too often have we substituted waste land for forest and farm land, flooded and polluted streams for clear and quiet rivers.

The first responsibility lies with the biologist. I have spoken glibly of the natural chain of events, but do we understand nature? In some cases we have learned general, basic principles, but in many cases the biologist does not know and cannot honestly foresee the results of a new engineering development. From my personal experience on the biological effects of pollution, I know that diametrically opposed views on many biological problems can be staunchly maintained by the experts. I pity the poor engineer who turns to the biologist for advice.

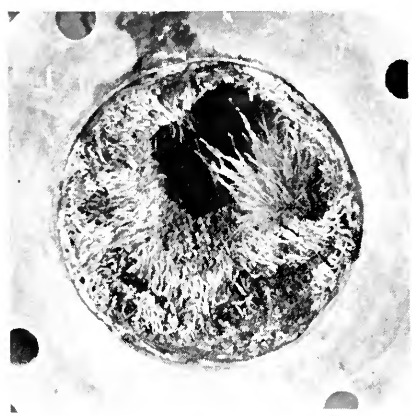
Man not Essential to Nature

The biologist has failed to keep ahead of the development of our civilization largely because we consider man the most important biological entity in the world. Biological training at colleges is frequently limited to the pre-medical courses but, with all due respect to our medical colleagues, the science of biology would gain greatly if the early biological training were more concerned with broader aspects of nature and natural processes. We must recognize the fact that man is important to himself but not terribly important to biological life. If man were to disappear from the face of the earth tomorrow, most of life would go on unchanged. However, if the processes of photosynthesis by green plants were to stop tomorrow, man would continue to live only as long as the stock on the grocer's shelf lasted. Only a little longer would be required to terminate all life on this planet if the bacterial processes were to be stopped abruptly.

In spite of the importance of the plants and bacteria, many people can consider themselves biologists with never a course in botany, plant physiology, or bacteriology. Thus the biologists themselves have a tremendous responsibility in training new men "to study nature not books", living processes, not dead and preserved material.

What is the responsibility of the engineer in a co-operative society? Clearly, he cannot be expected to know, to understand and to apply the basic principles of nature until the biologist has done his part. However, there is a responsibility which the engineer can accept immediately; the responsibility of thinking of the next generation and not only of his own. It is easy to forget the future and to consider only immediate gain, but, the future will not always be distant, and a natural resource once lost will cost more to regain, if that is at all possible, than it would cost to preserve. Can we be sure that the resources that we use so lavishly today may not be essential for mankind in the future?

A fairly typical attitude of engineers may be used to illustrate this point. Almost invariably, when a pollution problem is under consideration, the engineer's approach is to compare the total salary paid by the industry with the income derived by the fishing interests which may be endangered. This comparison always favors industry, but is it not specious and false reasoning to say that because industry is wealthy the fisherman should be willing to sacrifice his livelihood? Will not the factory worker suffer ultimately for each natural resource lost and for each recreation area destroyed?



Growth of tubeworms in a ship's 4 inch fire main. Official U. S. Navy photograph.

I realize that I am asking a great deal of the engineers in this regard. He is invariably faced with an economic dilemma. The proficiency of the engineer will be judged in terms of how economically he can devise a treatment plant which will meet

standards. However, with our expanding economy, the cost of proper, more expensive plants is quickly absorbed by increasing demands for the product. Federal, state and local authorities have already placed many restrictions on the use of our natural waters. A realistic view of the future indicates the inevitability of additional restrictions. If the engineer's sights are set high, he will be in the forefront of a gradual improvement; if he is complacent, he will be constantly subject to the external imposition of controls.

Dams, oysters and salt

An example of excellent co-operation between engineers and biologists was afforded by the recent Delaware Diversion problem. New York City proposed a reservoir in an upper branch of the Delaware River. Locally, a man-made lake would be substituted for farmland and forest, and the problems associated with this change in the natural environment are well known. But two hundred miles downstream from the dam, where the river meets and mixes with the sea, are extensive oyster beds and fishing grounds. What effect would the impounding of the river water have on this important food resource? Our American oyster is a fussy creature and so, fortunately, are his natural foes. The oyster lives midway between the river and the sea, and if the water surrounding him gets too salty or too fresh he dies. The oyster's natural foes cannot stand as much fresh water as the oyster, so that they are held back leaving a part of the estuary where the oyster can thrive.

What would be the effect of the reservoir on the oyster and its foes? The water retained by the dam during high river flows could be expected to benefit the oyster population since this would prevent the arrival of too much fresh water, but if too much river water were removed the sea would advance upstream and with the salt would come the foes of the oyster. Periods of low river flow were the dangerous times, and the reservoir has been planned to release water to the river during dry spells, when the natural flow of the river would be dangerously low and threaten the oyster with an invasion by his natural enemies. Thus, man's engineering was designed to improve upon nature.

An oyster boat on Chesapeake Bay.

How many engineering projects can be designed to improve upon nature? Flood control of rivers not only benefits man, but can also be expected to benefit the aquatic life and the terrestrial populations along the banks. Some pollutants are good fertilizers and may increase the biological productivity of the waters receiving them. On the other hand, excessive fertilization may stimulate aquatic weeds to the detriment of the desired population. As I have stated, most engineering practices which affect the environment change the biological populations. Each instance must be evaluated on its own merits.

We have wasted our forests and —

Radioactive wastes

The results of the most challenging engineering development in history are in sight, the tremendous values and potentialities of the dawning era of atomic power. In addition to its benefits to mankind, atomic power presents enormous biological and engineering problems. The possible effects of fission product wastes on the ecological system cannot be overemphasized. Today the biologist knows little or nothing concerning the problems with which he will be confronted when atomic power plants are in full operation. The production of power from fissionable material is associated with the production of enormous quantities of radioactive wastes, which also contain vast amounts of unbridled energy. It is the engineer's problem to devise ways of using this energy, so that instead of being wasted, it can be utilized. It would be overoptimistic to expect that all of the waste can be used and we must face the serious problem of what to do with the unusable fraction.

The oceans are enormous, and form a vast reservoir for our waste products. In the past, it has seemed inconceivable that man could produce enough of anything that he was willing to throw away to make any significant or measurable change in the open ocean. But the quantity of atomic power that may be developed within our lifetime would produce enough radioactive waste products within a year to make a detectable change in the ocean, even

polluted our streams.

though they were uniformly distributed from shore to shore and from surface to bottom. Successive accumulations, year after year, would have an unpredictable influence on the whole life cycle in the sea. This problem cannot be solved by hope and guesswork, for an error made now could have far reaching effects on future generations.

It is of vital importance that the biologist learn to recognize the normal biological conditions in this world and to evaluate any possible changes that might be introduced by engineering developments. It is the engineer's responsibility to keep abreast of the biological studies and to remember that man cannot live for today alone. The magnitude and importance of atomic energy developments merely emphasizes the necessity for thinking of the future as we plan for today.

About the Author

This article was based on a talk presented by Dr. Ketchum at the 75th anniversary meeting of the American Society of Mechanical Engineering at Boston, Massachusetts.

Dr. Ketchum is a Senior Oceanographer at the Institution. In addition to purely scientific studies he has made important applications of oceanography to practical problems, such as the disposal of wastes in natural waters and the prevention of fouling by marine organisms.

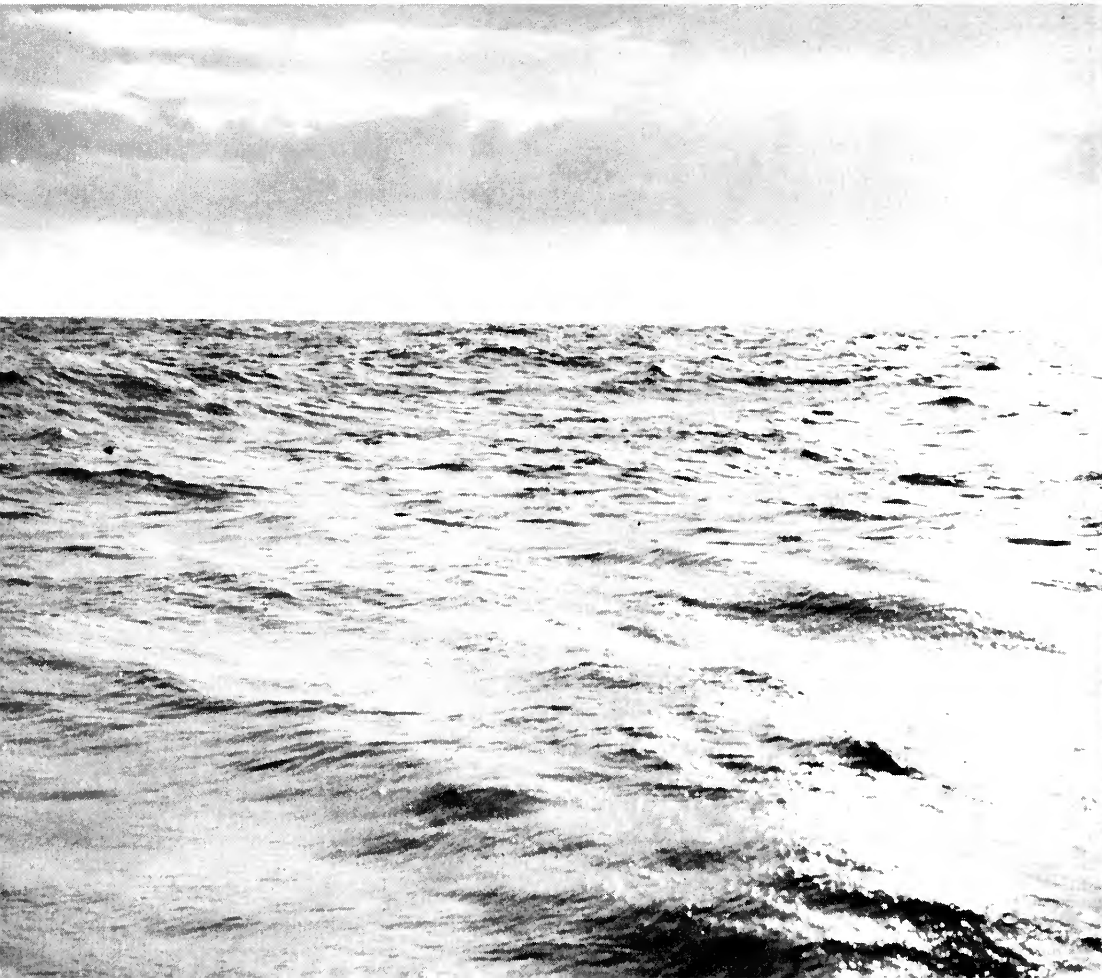
GIFTS AND GRANTS

OUR Director, Rear Admiral Ed. H. Smith, USCG (Ret.), announces the following gifts and grants:

Bendix Aviation Corporation	$500.00
The James Foundation of New York, Inc.	$10,000.00

The James Foundation gift was made as a contribution toward the cost of producing our motion picture on oceanography.

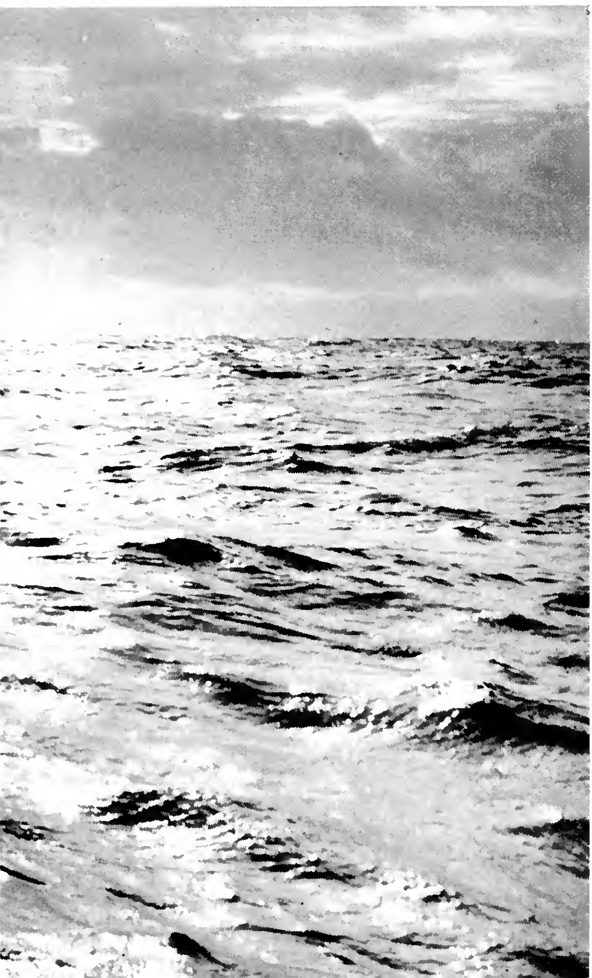
Under the Saltonstall-Kennedy Act the Institution has received a grant of $200,000 for a period of three years. This grant from the Department of the Interior, Fish and Wildlife Service, is to be used



to investigate the climatic and oceanographic factors influencing the environment of fish. The basic question "Why do the abundance and distribution of the great fish populations change from time to time?" is a most fundamental one to the fishing industry.

Work has started on the program with oceanographer Dean F. Bumpus in charge. His associates are Joseph Chase, research associate in meteorology; C. Godfrey Day, research assistant, and Lawrence K. Coachman, summer Fellow.

This most important program will be discussed in the fall issue of OCEANUS.



The oceans are enormous . . .

Associate Fellowship 1955-56

Roderic B. Park

Last spring an announcement of the Woods Hole Oceanographic associates Fellowship was sent to many colleges and universities. This program, supported by your funds, allows an annual grant to a promising college graduate who has shown marked ability and a keen desire to pursue higher education in the earth sciences. If the candidate proves satisfactory, successive reappointments will follow toward the normal three-year period of graduate education leading to the doctoral degree. One fellowship has been awarded this year, two will be given in 1956–1957 and three yearly thereafter.

We are pleased to announce that Mr. Roderic B. Park has been chosen to be the first recipient of the Associate Fellowship. Mr. Park received a B.A. degree from Harvard University and has done graduate work at the Scripps Institution of Oceanography and at the California Institute of Technology, he expects to receive his doctorate from the latter Institute in 1957. His major field of specialization is plant biochemistry. In June of this year he read a paper, "Indole acetic acid inhibition of root growth", at the Berkeley, California, meetings of the American Association for the Advancement of Science. An unpublished manuscript is entitled: "A photosynthetic action spectra of blue-green algae".

No stranger to the sea, Mr. Park attended Tabor Academy in Marion, Mass., made two cruises to Labrador on the schooner Blue Dolphin and several cruises on the R. V. *Bear*, while employed at the Institution during 1953.

At the end of that summer he married Maria Cornelia de Jong at Woods Hole; the couple have one child, Barbara Bruce. During the present summer Mr. Park holds the Arthur McCullum scholarship at the California Institute of Technology.

Corporate Associates

Since the last announcement the Stanolind Gas and Oil Company of Tulsa, Oklahoma, has joined the Corporate Associates.

Representatives of The Glenn L. Martin Company and of the California Research Corporation have taken advantage of their Associate's privilege to visit the Institution for consultation with our scientists.

Labrador Expedition

BY

Susan Scholander

An investigation to determine how fishes and algae survive under arctic conditions was aided by the use of a prefabricated shore laboratory.

THE schooner Blue Dolphin sailed from Boothbay Harbor for Labrador on June 21 of last year with 19 members of an expedition sponsored by the Arctic Institute of North America. Three of the scientists came from the Woods Hole Oceanographic Institution carrying with them a complete laboratory, which was stacked on the deck as piles of plywood, ready for assembly and fully equipped, even to a pencil sharpener for the wall and cheesecloth curtains to cut down the glare of the arctic sun on the instruments.

In 1953, physiologists P. F. Scholander and L. van Dam had started to consider the question of the survival of fishes in water which was colder than the freezing point of their blood. The investigation actually originated on an earlier expedition of the Blue Dolphin, when biologist R. H. Backus found evidence of a considerable fish population which lived at the bottom of the deep fjords of northern Labrador in water of $-1.7°C.$, almost a whole degree below the freezing point of ordinary fish blood. This impossible situation was discussed at length with senior oceanographer A. C. Redfield and led to a trip to Baffinland in the spring of 1953. There Scholander and H. T. Hammel, after weeks of work with Eskimos and a dog team, caught one fish about three inches long, which yielded a few drops of blood for analysis.

As these data made a rather slim basis for publication, a second trip north was planned. It then developed that Commander David C. Nutt was fitting out for a summer expedition with the Blue Dolphin to make hydrographic studies along the Labrador coast, and welcomed the opportunity to combine these with a program in biology. This also opened up possibilities for the third member of the Oceanographic Institution to accompany the expedition. John W. Kanwisher, research associate in biophysics, had been interested for some time in the survival of algae and marine animals which freeze regularly during the winter along the shore around Woods Hole and had developed some ingenious methods for the determination of the ice they contained. The Labrador coast offered ideal conditions for similar studies on organisms which survive a much more rigorous winter than any at Woods Hole.

Since precise physiological analyses are often impossible on a ship, the Institution's boat carpenter K. Morrison set to work early in the spring to design a portable plywood "polar" laboratory. The biological program developed around the facilities made possible through such a steady and protected land-based establishment. The prefabricated panels were carefully marked and fitted together, and when the labo-

ratory was set up at Woods Hole all instruments could be arranged and techniques tested under simulated field conditions. The building had an area of eight by twelve feet, with three small windows on each side, a door at one end, and a wide working counter attached to the walls. The partial floor rested independently on the ground, so that its vibration would not affect the balances, microscopes, or other instruments on the counter. The working space, equipped with stools, was adequate for seven people, as long as they were organized, congenial, and not too active.

Since it was essential that there should be some means of pulling the fishes quickly to the surface from the deep waters of the fjord, it was planned to copy the system which had been used by Scholander and van Dam at the Lerner Marine Laboratory on Bimini in the Bahamas, where time had also been a critical factor in hauling up fishes from the deep waters of the Gulf Stream. This was done with an Air Force target-towing winch, run by a gasoline engine, which was installed in a small boat and adapted to pull up a steel fishing line. The U. S. Navy Bureau of Aeronautics provided the winch which was modified for use with a trawl by W. O. Bowman and L. S. Perry in the Institution's machine shop.

The vicinity of Hebron Fjord in northern Labrador was chosen as a suitable destination for the portable laboratory. Water temperatures of $-1.7°$ to $-1.8°$C. at the bottom of the fjord had been recorded in previous summers, and there was good likelihood that snow and ice would remain in patches along the shore for as long as they would be needed to produce freezing temperatures for laboratory determinations. In March, D. C. Nutt made a reconnaissance trip to this area, and engaged the services for the summer of Peter Hay of Nain, with a sturdy 30-foot Newfoundland motorboat, which could easily take the winch and its engine, as well as all the other fishing gear for the land party. Thus, once the laboratory was established on Hebron Fjord, the Blue Dolphin would be free to gather data in other areas, and the camp could operate independently for weeks.

With laboratory and collecting facilities so organized, it was possible to consider opportunities for bacteriological studies, and the expedition was fortunate to be able to add to its membership W. J. Nickerson, Professor of Microbiology at Rutgers University. Another welcome recruit was Malcolm S. Gordon from Cornell University who had sailed on the Blue Dolphin before and had valuable experience with the biological conditions along the Labrador coast.

The knocked-down laboratory and the winch were loaded on a truck and transported to Boothbay Harbor, where early in June Commander Nutt had gathered his ship's complement and personnel for hydrographic studies.

The algologist, R. T. Wilce, from the University of Michigan, preceded the Blue Dolphin to Labrador, and after collecting in the vicinity of Red Bay joined the expedition there. Susan Scholander and Joan Kanwisher traveled on the supply steamer which in the summertime plies along the Labrador coast from Newfoundland. They met the expedition at Nain on July 5th where Peter Hay also came on board and his boat was taken in tow to Hebron.

Settling down

The Blue Dolphin proceeded slowly up Hebron Fjord on July 7, and after several exploratory shore expeditions, the white tents of an Eskimo fishing camp were sighted about 17 miles from the coast. This camp

was situated on a grassy slope near the shore in close proximity to streams of melt water which ran down from the high mountains along the fjord. A laboratory site was chosen about a mile from this settlement. There were streams on both sides, and a large snow field in a hollow nearby. Taking advantage of a comparatively windless evening, the crew of the Blue Dolphin unloaded the laboratory and the tents and set them up within a few hours' time. The remainder of the equipment was unloaded the next morning, and the schooner sailed away, leaving ashore a party of nine, the Scholanders, the Kanwishers, Nickerson, van Dam, Wilce, Gordon, and Peter Hay.

The laboratory formed the focal point of operations to an even greater extent than was anticipated, and as many as eight at a time could manage to work there, although this was beyond the planned capacity. The space along one side beside the door was occupied by a large waterbath containing a series of small respirometer vials, where Mrs. Kanwisher and the authoress determined the respiratory rates of some of the arctic plants and insects. The rest of that side was taken up by Scholander and Gordon with apparatus for the determination of the freezing point of fish blood. At the far end of the laboratory van Dam did the chemical analyses, and Kanwisher beside him worked on ice determinations. Nickerson and Wilce covered the remaining side with bacterial cultures and algae collections, and there was still space at the end beside the door for a kerosene or Primus stove and a drying oven.

The prefabricated laboratory at Hebron Fjord.

Large U. S. Army regulation tents were used for living quarters, for the storage of spare equipment, and food supplies, and for cooking. The cooking was done on a Coleman two-burner gasoline stove and a two-burner kerosene stove. In a small portable oven, placed on top of either stove, bread could be baked and even burned. Fresh fish were available throughout the summer in great quantities. Enough cod could be caught within a few minutes for dinner by hook and line bottom fishing without bait. Char were obtained regularly from nets just offshore. On a knoll near the camp a fish smoker was built of an old gasoline drum. In the hollow below, fuel

for the fire was provided by crowberry turf from the tundra, and the smoke was cooled by channeling it up the slope into the smoker. After the fish had been split through the back bone, covered with rock salt and dried in the sun for a day, they were hung by the tail in the smoker for a day or longer, with the two sides of the fish held apart by twigs. The supply of smoked char was generally excellent and ample, in spite of several occasions when the fire got too hot and the fish so well cooked that they fell down the smokepipe.

Fish, mosquitos and plants

After the winch was installed on the motorboat, deep hauls were made in the fjord almost every day of good weather to obtain fish from the cold water for freezing point experiments. The crustaceans brought up in the net provided many shrimp cocktails, and to those who were more venturesome even hermit crab canapes were a delicacy. Mushrooms (*Boletus scaber*) could sometimes be obtained in sufficient quantity to add variety to the menu.

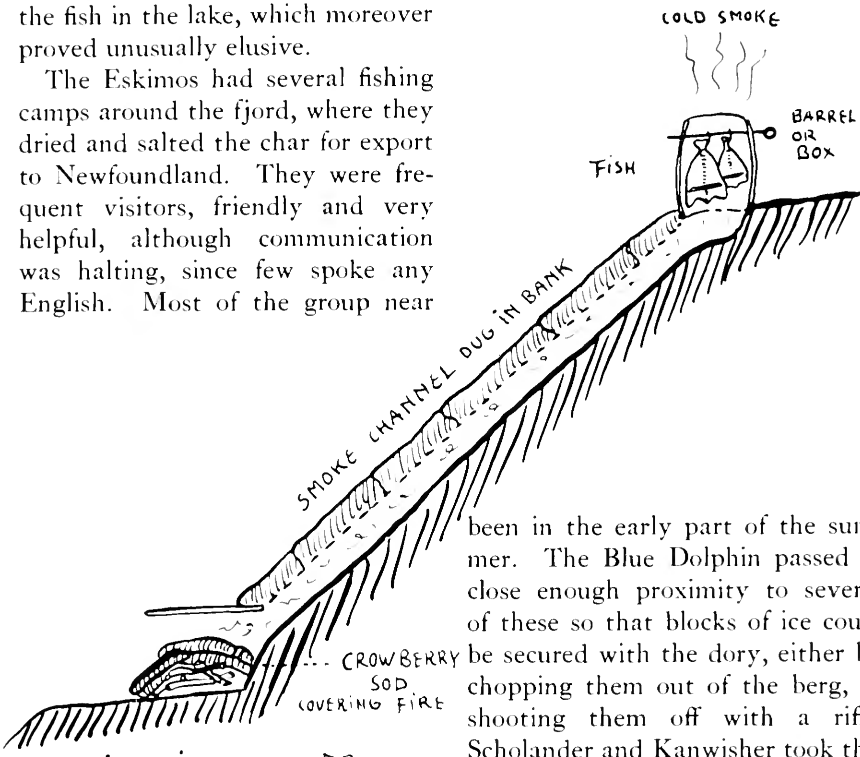
We kept the cook tent fairly free of mosquitoes and flies with liberal insect spray, and a screen door on the laboratory eliminated the problem there. On cold days the laboratory could always be kept warm, with no more than a Primus stove. On warm days, with the sun beating on the roof, it was more of a problem to cool it, but a canvas tarpaulin could be arranged as a shield to eliminate most of the direct heating. The weather was prevailingly sunny and clear, and in July the sun barely dropped below the horizon at night. By August darkness fell much earlier, and then the aurora borealis was bright overhead.

The actual period for working turned out to be very short, and time for exploratory trips proved unexpectedly limited. Walking and collecting was relatively easy over the tundra, as long as the dense thickets of low willow and birch could be avoided. In early July the ground was white with the blossoms of Labrador tea and bakeapple. Later in the summer these were replaced with the deeper colors of the arctic fireweed, bluebells, and goldenrod. In August the blueberries and cranberries were beginning to ripen around Hebron, and a little to the south, at Nain, the bakeapple berries were at their prime. Lichens were conspicuous and varied everywhere, and several members of the party made collections to identify and take home. Some of the plants growing right around the camp provided material for respiratory studies, with a view towards later comparison with the same or closely related species growing in warmer climates. Fresh water aquatic material, however, involved more search. The long valley at the end of the fjord, some 15 miles farther inland, proved to be a fertile place, carpeted with fireweed, cotton grass, and bluebells. Some of the water plants common to Labrador and more southern localities were found in pools in this valley. Others were found in a string of small lakes on the other side of the mountain from the camp, a stiff half hour's climb away. Towards the end of the summer a study was undertaken of the physiological adaptations in fish which migrate regularly from salt water to fresh. Salt water char were easily obtained, but the search for their fresh water counterparts led to the exploration of a large lake surrounded by spec-

tacularly rugged mountains near one branch of the fjord. This involved poling and scraping the dory up the long shallow stream which ran down the valley from the lake to the fjord, and the task was not much easier when the party returned with an outboard motor and nets to seine the fish in the lake, which moreover proved unusually elusive.

The Eskimos had several fishing camps around the fjord, where they dried and salted the char for export to Newfoundland. They were frequent visitors, friendly and very helpful, although communication was halting, since few spoke any English. Most of the group near the camp had moved on to new territory by the end of July, but all were on hand when the Blue Dolphin arrived on August 15 to dismantle the laboratory and take the land party aboard. Although the Eskimos seemed embarrassed with gifts, they eagerly salvaged whatever was left behind of food, clothing, or scraps of wood.

The plywood laboratory was unloaded from the Blue Dolphin at the Moravian Mission house in Hebron and stacked up for the use of future expeditions, before the ship started for Boothbay Harbor on the evening of August 15. On the southward trip icebergs of considerable size were more numerous than they had been in the early part of the summer. The Blue Dolphin passed in close enough proximity to several of these so that blocks of ice could be secured with the dory, either by chopping them out of the berg, or shooting them off with a rifle. Scholander and Kanwisher took this opportunity to test a field method for the determination of gases in water, using small samples from the icebergs as material and a somewhat sheltered corner of the deck as a laboratory. In this region the icebergs are of Greenland origin, formed many ages ago of compacted snow. The gases which were trapped within this snow from another era are preserved in minute bubbles in the ice, and represent samples of fossil atmosphere.



ARCTIC FISH SMOKER

Survival of Arctic fishes

The problem of the survival of arctic fish in cold water seemed no nearer solution when the biologists left Hebron Fjord than when they arrived. During the previous winter analyses of the blood from the one fish caught in Baffinland indicated that this fish avoided freezing by increasing the concentration of its blood until it had a freezing point almost equal to that of the sea water in which it was swimming. At Hebron Fjord in the summer the blood of the fishes caught at the surface had a concentration only about half as great as that of the fishes in the winter, and when they were placed in a bath of freezing sea water they froze immediately, as was expected. The surprising thing was that the fishes from the deep water of Hebron Fjord showed almost the same blood characteristics as the surface fishes, and they also froze instantly in a bath of cold sea water at -1.7, although this was exactly the same temperature at which they normally lived on the bottom of the fjord. The biologists argued that the fish could not be wrong, and as a last resort they undertook to check the oceanographers' reversing thermometers. This last loophole was plugged when they found that their own laboratory thermometers were off by a few hundredths of a degree, and there was nothing to do but accept the fact that in the deep waters of Hebron Fjord the temperature of the water is -1.7 and at this temperature at the bottom of the fjord a whole fish fauna is living which will freeze at the same temperature on the surface. The mystery was solved in Woods Hole during the following winter by a chance observation on Fundulus. These fish had been kept in the laboratory supercooled for several hours without harm when they accidentally came into contact with an ice crystal and froze. At Hebron Fjord the water bath used to test the fish was cooled by freezing out pieces of ice from relatively brackish water, and enough ice crystals were present to seed and freeze the fish. On the bottom of Hebron Fjord, however, fish can live supercooled indefinitely, and since ice can never occur there the potential instability of their state is no detriment.

The base a success

Much of the summer's biological data would have been impossible to obtain except through a land-based operation. The time was short, and some of the work was felt to be only preliminary. Its significance in indicating a means of approach to problems in arctic biology, however, was obvious early in the summer. With suitable means of transportation, it is an easy matter to pick the most promising location for any investigation and there set up a temporary laboratory, with such a steady and established base, and with due organization and preparation beforehand, there is no limit to the operations that may be performed. In the Hebron laboratory power requirements were carefully geared to the capacity of six volt Hot Shot batteries, and the worries involved in using a generator were eliminated. For the microbiological studies sterilization was done in a pressure cooker on a kerosene stove, and a hand centrifuge functioned under field conditions just as efficiently as more elaborate models in institution laboratories.

Although the snow fields began to disappear quickly in August, the occasional large pieces of floating ice in the fjord proved sufficient to cool the waterbaths and provide freezing temperatures as long as they were needed in the laboratory. The fresh water streams dwindled steadily, and the distances traversed

by the bucket brigade increased to as much as half a mile toward the end of the summer, but with care the supply continued to be adequate. The deep waters of the fjord in front of the camp maintained their below freezing temperatures as well as their below freezing fish fauna throughout the season, so that there fortunately was no reason to change the location of the camp during the summer. If, however, there has been need to move, the actual dismantling, loading, and re-establishment of the camp would have been no more than a day's work, with the help of the Blue Dolphin. Transportation of personnel and limited supplies is as efficient by air and dog team in the winter as by vessel in the summer, and as long as the field laboratory could be set up during the warm weather it could easily be adapted to winter conditions also, with proper insulation, provision for heat and for protection from wind and drifting snow.

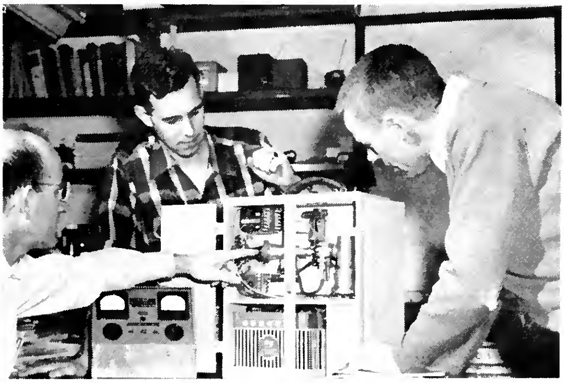
About the Author

Susan Scholander started her scientific career by helping her father, Dr. Laurence Irving at Swarthmore College. There she met Dr. Per F. Scholander who had come from Norway on a Rockefeller Fellowship. She has been assisting her husband since their marriage. She has also worked in the Bird Department of the Museum of Natural History for Dr. Robert Cushing Murphy.

What is the Weather in Florida?

The meteorological group of Mr. A. H. Woodcock has departed for Florida in our Stinson aircraft, piloted by Mr. Robert G. Weeks. Flying along the Florida coast, Mr. Woodcock, Duncan Blanchard and A. T. Spencer will make observations on the sea salt nuclei in the air. Mr. Woodcock's recent research has indicated that minute drops ejected from breaking bubbles at the sea surface are the nuclei which are the beginning of each raindrop.

Ingenious instruments designed by the meteorological group are attached to the plane to count the number of sea salt nuclei in the air. The program is supported by funds from the Office of Naval Research, U.S. Navy.



"Sniffy" measures the number of condensation nuclei in the air. Being tested by A. H. Woodcock, Duncan Blanchard and A. T. Spencer, the instrument "sniffs" eight times per second. A photocell measures the light emitted from a little cloud formed by each sniff.

The hurricane studies of Dr. Redfield and Mr. A. R. Miller were the subject of an article "Anatomy of the Big Wind", published in the May 30th issue of *Newsweek.*

A two day conference on the disposal of radioactive wastes was held in the Laboratory of Oceanography. Members of the Atomic Energy Commission, scientists from Johns Hopkins University and oceanographers from many parts of the country attended the meetings.

Dr. C. B. Officer has accepted appointment as Assistant Professor of Geophysics at Rice Institute, Texas. A new department of Earth Sciences has been founded at the Rice Institute, including sections of geophysics, geochemistry and geobiology. Dr. Officer will remain a staff member and will return to Woods Hole during the summer.

Dr. Roman Vishniac, well known photographer of the microscopic world is again a visitor at the Institution. He was the subject of a profile in two July issues of the *New Yorker* magazine. Commenting on his difficulties to photograph plankton in such a way that they could be used in a syncopated film, Dr. Vishniac stated: "It is difficult for plankton to make them square dance".

Dr. J. B. Hersey returned recently from a visit to British oceanographic and geophysical laboratories.

Vigorous, inspiring, staff meetings have been held during July. Among those presenting talks were Professor C. G. Rossby, Director of the Institute of Meteorology, University of Stockholm, Dr. Harry Wexler, Deputy Chief of the U. S. Weather Bureau and Dr. M. Ewing, Director of the Lamont Geological Laboratory, Columbia University. Drs. Rossby and Ewing are staff members of the Institution.

Dr. and Mrs. P. F. Scholander are leaving for Norway in August. Dr. Scholander has accepted the position of Professor of Zoology at the newly founded Zoophysiology Institute, University of Oslo. Their departure will be most regretted.

Dr. Peter Dohrn, Director of the Naples Marine Biological Laboratory visited here in July. He is the grandson of Dr. Anton Dohrn, founder of the Naples Laboratory which became the example for other marine laboratories throughout the world. During the war this Institution had a small research vessel named *Anton Dohrn.*

"Polarized light and animal navigation" is the title of an article by Dr. Talbot H. Waterman in the July issue of Scientific American. Last winter Dr. Waterman worked on the problem of aquatic animal navigation at the Institution and on board the Research Vessel *Atlantis.*

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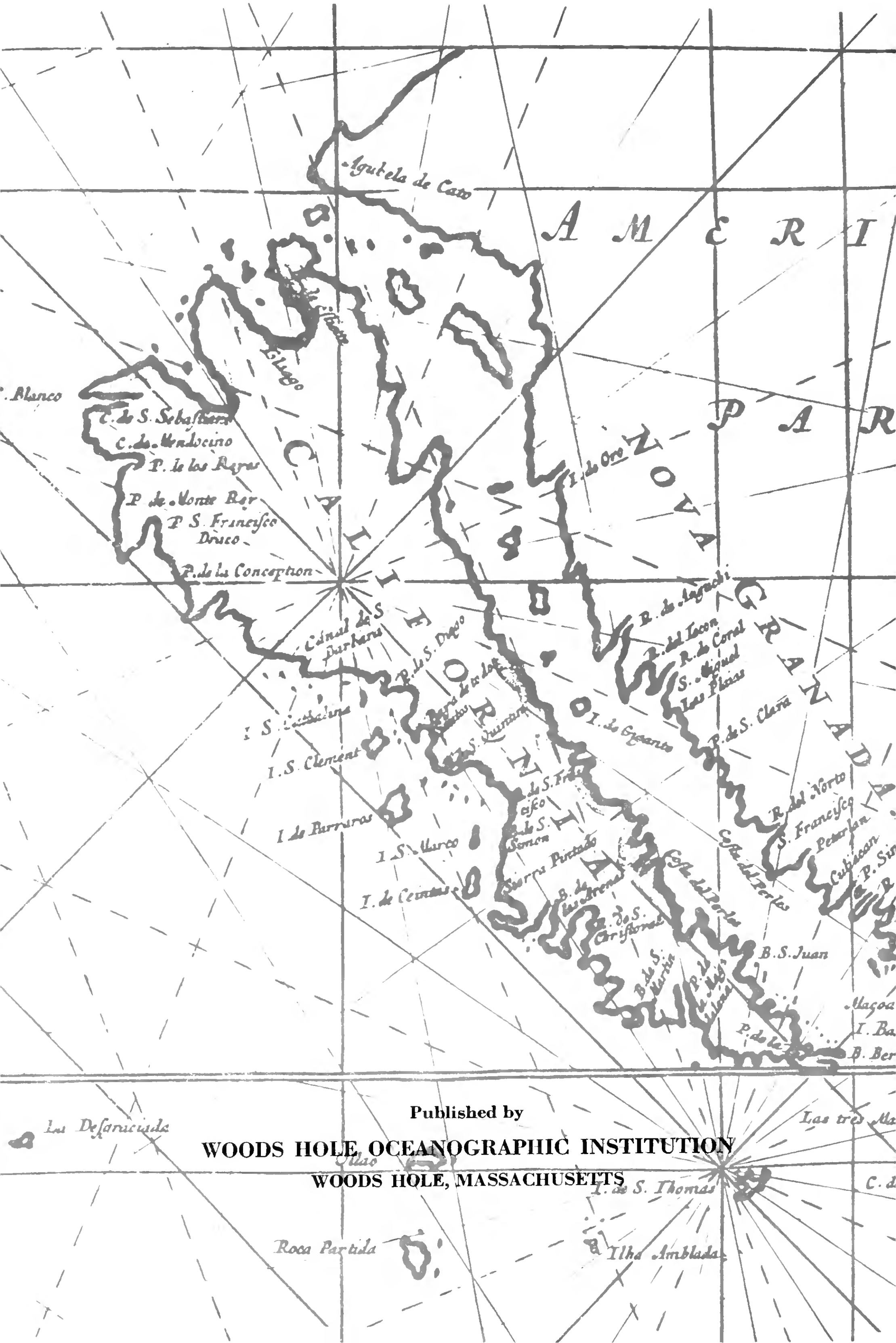

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